

Sauropterygia\*, the ulna, 55, is broader than the radius, 54 (Pl. VIII. fig. 1); and I would submit whether the antibrachial bones have not been transposed in Prof. Marsh's figures, and the ulna (marked *r*) placed at the radial side of the forearm. In the copy of his fig. 1, in Pl. VIII. fig. 1, I have indicated the several bones and digits by the symbols used in my 'Archetype of the Vertebrate Skeleton,' pl. i., as also in the figures 1-4 of the fore fin in the Quart. Journ. Geol. Soc. for August 1878, p. 749. In the copy of Prof. Marsh's fig. 2 in my Pl. VIII. I have transposed the position of the radius and ulna, agreeably with the analogies above referred to. To the restoration of the pelvic arch and appendages (Pl. VIII. fig. 3) I have nothing to object.

The sum of Prof. Marsh's observations on his rich series of American generic or subgeneric forms of Mosasaurians is as follows:—"The new characters above presented are all Lacertian rather than Ophidian. The important characters of the Mosasaurians now known indicate that they form a sub-order of the Lacertilia, which should be called *Mosasauria*"†. In this conclusion I entirely concur: it is that to which I was led after comparison of the evidences of the extinct group at my command in 1877 ‡.

#### EXPLANATION OF PLATE VIII.

- Fig. 1.* Sternum, scapular arch, and bones of the pectoral fins. (*Edestosaurus*.)  
*Fig. 2.* Bones of the pectoral fin, with Marsh's position of the antibrachial bones reversed. (*Lestosaurus*.)  
*Fig. 3.* Pelvic arch and bones of the pelvic fins. (*Lestosaurus*.)

#### PROCEEDINGS OF LEARNED SOCIETIES.

##### GEOLOGICAL SOCIETY.

November 19, 1879.—Henry Clifton Sorby, Esq., F.R.S.,  
 President, in the Chair.

The following communication was read:—

"Supplementary Note on the Vertebræ of *Ornithopsis*. Seeley (= *Eucamerotus*, Hulke)." By J. W. Hulke, Esq., F.R.S., F.G.S.

The author in this communication describes several cervical and trunk vertebræ of this remarkable Dinosaur. The former are cha-

\* 'Monograph on the Fossil Reptilia of the Liassic Formations.' 4to. In the Palæontographical volume, issued 1865, pl. i. *Plesiosaurus dolichodeirus*; pl. ix. *P. rostratus*; pl. xiv. fig. 4. *P. macrocephalus*, fig. 6. *P. Hawkinsii*.

† *Op. cit.* p. 87 (1880).

‡ *Loc. cit.*

racterized by great length; the anterior articular surface is strongly convex, and the posterior correspondingly hollow. In place of the side chamber characterizing the trunk-vertebral centra, is a long shallow pit. An upper and a lower transverse process are given off from an upper and a lower plate, which project from the side of the centrum above the pit; and these are connected by a short forked cervical riblet. The neural arch is dwarfed; and there is no spinous process, and no zygosphenal and zygantral mechanism. The structure of these vertebræ indicates a long, mobile, and light neck. In the trunk the convexity of the anterior articular surface lessens in passing from the neck to the loins, the anterior ball gradually subsiding till the great articular surface becomes plane, the posterior surface retaining, however, a slight hollowness. The trunk-vertebræ have superadded to the ordinary articular processes a mechanism comparable to zygosphenic and zygantrum, which must have given great fixity to this part of the vertebral column, contrasting strongly with the flexibility of the neck. The longitudinal side chambers reach their greatest development in the vertebræ referable to the fore part of the trunk; they lessen toward the loins, and are absent from the neck—which is regarded as conclusive of their pneumaticity, and against their having been occupied by cartilaginous and fatty tissues, which might have equally occurred through the whole length of the vertebral column, and not been limited to a particular region in close vicinity to the lungs. The whole construction affords a notable illustration of immense bulk attained with the use of the smallest quantity of bony tissue, which occurs in the form of very thin sheets or plates. The transverse and spinous processes are strengthened by flying buttresses. The vault of the neural canal is beautifully groined, whence the original name *Eucamerotus*. The author then pointed out the family resemblances between this Isle-of-Wight Wealden form and the new Colorado Dinosaurs, which have many points in common, but the latter are both generically and specifically distinct from *Ornithopsis*.

December 3, 1879.—Henry Clifton Sorby, Esq., F.R.S.,  
President, in the Chair.

The following communication was read:—

“On some undescribed *Comatulæ* from the British Secondary Rocks.” By P. Herbert Carpenter, M.A., Assistant Master at Eton College.

This communication contains descriptions of seven new *Comatulæ* from the Cretaceous and Oolitic series of Southern England, together with some new facts respecting the *Glenotremites paradoxus* of Goldfuss, from the Upper Chalk. This species is remarkable for the presence of certain characters which are very conspicuous in the recent *Antedon Eschrichtii*, and also in a new species dredged by the ‘Challenger’ at Heard Island in the South Atlantic—namely, the presence of strong ribs on the inner wall of the centrodorsal, five of

which, interradiar in position, are much more prominent than the rest. So far as is yet known, these features occur in no other recent Comatula, with the exception of one species from the South Pacific, in which there is a faint indication of such ribs, but they are all equal. Another *Antedon*-species is described from the Chalk of Sussex. It differs from *Antedon paradoxa* in the absence of these ribs, and in the shallowness of the centrodorsal cavity.

Two species are described from the Gault of Folkestone. One is an *Antedon* with no special relations to any recent forms. It might have lived as well at 20 as at 500 fathoms. But the other species is an *Actinometra*, possessing certain characters only known to occur in species from quite shallow water, 20 fathoms or less, in the Philippine Islands and Malay archipelago. The centrodorsal is a flat plate, nearly on a level with the surface of the radials, or sometimes even below them, separated from them by clefts at its sides, and entirely devoid, not only of cirri, but also of cirrus-sockets. This condition is only an extreme stage of the metamorphosis of the centrodorsal piece, which bears cirri for a time after its liberation from the larval stem; but these cirri eventually disappear, and their sockets become obliterated. The 'Challenger' collection contains a series of specimens of *Act. Jukesii* from Torres Straits, which illustrate this point very completely; and it is therefore of no small interest to find a fossil Comatula which shows one of the extreme stages of the metamorphosis.

The large size of the three *Antedon*-species from the Chalk and Gault is very remarkable. *Ant. paradoxa* has a centrodorsal half as wide again as that of any recent form; while *Ant. Eschrichtii* is the only recent species with a centrodorsal approaching the size of those of the other Chalk *Antedon* and of that from the Gault. *Act. Lovéni* from the Gault, however, and the older Comatulæ, all had small calices like most recent species. An elegant centrodorsal (*Ant. rotunda*) is described from the Haldon Greensand, and also two species from the Bradford Clay. One is an *Antedon*, the oldest known, with no special characters; the other is an *Actinometra*, with a centrodorsal essentially like those of species now living in shallow water in the Philippines and Malay archipelago. The oldest known Comatula, an *Actinometra* from the Bath Oolite, has similar relations.

December 17, 1879.—Henry Clifton Sorby, Esq., LL.D., F.R.S.,  
President, in the Chair.

The following communications were read:—

1. "A Contribution to the Physical History of the Cretaceous Flints." By Surgeon-Major G. C. Wallich, M.D.

The author described the origin, the mode of formation, and the cause of the stratification of the Chalk flints. Taking as the basis of his conclusions the fact brought to notice by him in 1860, namely that the whole of the Protozoan life at the sea-bed is strictly limited

to the immediate surface-layer of the muddy deposits, he pointed out in detail the successive stages of the flint-formation, from the period when the chief portion of the silica of which they are composed was eliminated from the ocean-water by the deep-sea sponges, to the period when it became consolidated in layers or sheets conforming to the stratification of the Chalk. In relation to this subject the author claimed to have sustained the following conclusions:—1. That the silica of the flints is derived mainly from the sponge-beds and sponge-fields, which exist in immense profusion over the areas occupied by the Globigerine or calcareous “ooze.” 2. That the deep-sea sponges, with their environment of protoplasmic matter, constitute by far the most important and essential factors in the production and stratification of the flints. 3. That, whereas nearly the whole of the carbonate of lime, derived partly from Foraminifera and other organisms that have lived and died at the bottom, and partly from such as have subsided to the bottom only after death, goes to build up the calcareous stratum, nearly the whole of the silica, whether derived from the deep-sea sponges or from surface Protozoa, goes to form the flints. 4. That the sponges are the only really important contributors to the flint-formation that live and die at the sea-bed. 5. That the flints are just as much an organic product as the Chalk itself. 6. That the stratification of the flint is the immediate result of all sessile Protozoan life being confined to the superficial layer of the muddy deposits. 7. That the substance which received the name of “*Bathybius*,” and was declared to be an independent living Moneron, is, in reality, sponge-protoplasm. 8. That no valid *lithological* distinction exists between the Chalk and the calcareous mud of the Atlantic; and, *pro tanto*, therefore the calcareous mud may be, and in all probability is, “a continuation of the Chalk-formation.”

2. “Undescribed Fossil Carnivora from the Sivalik Hills, in the Collection of the British Museum.” By P. N. Bose, Esq., B.Sc.

This communication contained descriptions of nine species of Carnivora from the ossiferous Sivaliks, together with an introduction, in which the age of the Sivalik fauna, and several matters of general interest, were briefly discussed. The species described were:—*Machærodus sivalensis*, *M. paleindicus*, *Felis grandieristata*, *Hyæna sivalensis*, *H. felina*, *Viverra Bakerii*, *Lutra paleindica*, *Canis curvipalatus*, and *C. Cautleyi*.

*Canis curvipalatus* is so named on account of the curvation of the palate. *C. Cautleyi* is closely allied to the Wolf, as is *Viverra Bakerii* to the Civet. The form of the forehead is peculiar in *Lutra paleindica*. In the form of the skull, the dimensions of the upper tubercular, &c., *Hyæna sivalensis* approximates to the living Indian *Hyæna* (*H. striata*); but in the absence or extremely rudimentary character of the postero-internal cusp in the lower carnassial, as well as in the entire absence of the anterior accessory cusps in the upper and the first two lower premolars, the Sivalik

species comes closer to *H. crocuta*. *H. felina* differs from all other species of Hyæna, living or extinct, in the absence of the upper premolar 1. *Felis grandicristata*, which was of about the same size as some of the larger varieties of the Royal Tiger, had the sagittal crest even more prominent than the *F. cristata* of Falconer & Cautley. *Machærodus sivalensis* was of about the same size as the Jaguar. One of the specimens, on which this species is based, shows two molars in the deciduous dentition instead of three (as in the genus *Felis*). *M. palæindicus* was considerably larger than *M. sivalensis*. Both differ from all other known species of *Machærodus* in the form of the lower jaw &c.

### MISCELLANEOUS.

*On Archaeopteryx macroura.* By Prof. CARL VOGT.

Prof. VOGT read before the last meeting of the "Société Helvétique des Sciences Naturelles," held at St. Gall in August 1879, a communication on *Archæopteryx macroura*. He remarked, first, that in 1861 Hermann von Meyer described a bird's feather found in the lithographic stone of Solenhofen in Bavaria, belonging to the Upper Jurassic deposits. The German palæontologist gave the name of *Archæopteryx lithographica* to the bird revealed by this feather.

In 1863 Prof. Owen described, under the name of *Archæopteryx macroura*, a much more important specimen from the same beds, and found by M. Häberlein, a doctor at Pappenheim. This was a slab showing with the greatest distinctness the hinder part of a bird, and also the feathers of the wings in disorder, as well as a few bones belonging to the anterior limbs.

M. Häberlein's son has discovered a new slab containing a second example of *Archæopteryx*, which Prof. Vogt has been able to examine. This new specimen is complete; and its wings are unfolded as if in flight.

The head is small; with the lens two small conical pointed teeth may be observed implanted in the upper jaw.

M. Vogt counted eight cylindrical cervical vertebræ, furnished with very fine, backwardly directed ribs. The dorsal vertebræ appear to be ten in number; they are thick and short, and bear no spinous apophyses. The ribs attached to them are very fine, slender, curved and pointed at the end; they show neither any flattening nor any traces of the uncinate apophyses which occur in birds. There are very fine sternal ribs, which appear to be attached to a linear abdominal sternum.

The pelvis is still involved in the matrix. The tail, which is very long, is preserved throughout its whole extent. However, it teaches nothing more than was known from Prof. Owen's specimen.

The posterior limbs, which are not, on the whole, so well preserved as in the first example, show nevertheless with perfect certainty